The topic of this thesis is the Jones polynomial of a given knot and its computation. First we define the Jones polynomial in two ways: using skein relations and using the bracket polynomial and we prove that these definitions are equivalent. Next we derive an algorithm for computation of the Jones polynomial based on its relation with the bracket polynomial. We prove that the time complexity of the algorithm is $\mathcal{O}\left(2^{0.823n}\right)$, where n denotes number of crossings in a link diagram. Lastly we present the results of running the algorithm and its variants on data. We test the algorithm among others on small table knots, bigger random knots and on torus knots. We estimate that the fastest variant of the algorithm runs on random knots with the average time complexity $\mathcal{O}\left(2^{0.487n+o(n)}\right)$.